

**A Paradigm Shift – The Key to
Optimal, Defensible & Transparent
Waste Management,
Disposal & Remediation Decisions**

WM2015 Panel Session No. 127

Phoenix, AZ

THIS PARADIGM SHIFT INTEGRATES THREE COMPONENTS

1. **Stakeholder Engaged Structured decision-making (SDM) to arrive at decision alternatives**
2. **Scientific/engineering methods to model the alternatives**
3. **A stakeholder engagement program**

INTRODUCTION OF CHANGE AGENTS

- Paul Dixon (LANL)
- Paul Black (Neptune & Co.)
- Laurel Boucher (The Laurel Co.)
- Kelly Black (Neptune & Co.)
- Tom Stockton (Neptune & Co.)
- Jeannette Hyatt (SRNL)

INTRODUCTION OF PANELISTS

- **Christine Gelles (U.S. DOE HQ)**
 - ❖ Role: DOE Program Owner
- **Robert Seifert (U.S. DOE HQ)**
 - ❖ Role: DOE Compliance Owner
- **Terry Spears (DOE Savannah River Deputy Site Manager)**
 - ❖ Role: DOE Site Mgr/Decision Maker
- **Daphne Neel (South Carolina Department of Health and Environmental Control)**
 - ❖ Role: State Regulatory Agency
- **Jean-Michel Bosgiraud (ANDRA)**
 - ❖ Role: International Perspective

**A
STAKEHOLDER
ENGAGEMENT
PROGRAM
PROVIDES FOR ...**

- **Stakeholder selection**
- **Stakeholder education and enrollment**
- **Shared Mission Statement**
- **Agreements**
- **A Coordinating Group/Function**

AUDIENCE PARTICIPATION AND INPUT

- Record your questions on index cards and hand them to Jeannette or Kelly
- Please fill out the survey questionnaire located in your seat. We need your feedback.
- If you want additional follow-up information, just leave a business card in basket located in the back

Why is a Paradigm Shift Needed?



Why is a Paradigm Shift needed?

- *Optimize* use of ever more scarce funding
- Move *beyond compliance* determinations
- Remove *conservatism*
 - over-engineering, creating problems that do not exist
 - use “reasonable realism” – will improve communication
- *Engage stakeholders* effectively

That is, put our money to better use

- current generation is footing the current unnecessary bill and maximize benefits to all stakeholders



Basic Issues

- Budgets are reducing
 - But problems are not going away – costs and time to complete keep increasing
- Conservatism!!!!
- Need to gain more from 30 years of:
 - Experience with environmental problems
 - Improved (computer) technology
 - Improvements in decision analysis methods
- Need to effectively engage stakeholders

*We can't afford our current approach –
it won't get us where we need to go*



Impacts on related decisions

Poor, or biased, decisions have other consequences, for example:

- Environmental management decisions impact:
 - Land withdrawal (make land available for re-use)
 - Continuing operations
 - Resources available for other environmental decisions (prioritization)
- Radioactive waste management decisions impact:
 - Ability to have a nuclear industry
 - Energy
 - Need a level playing field!
 - Medicine, other



Perspectives

- Environmental problems are diverse, however...
- ...the basic **process** for finding solutions should be the same
 - Past efforts, such as DQOs, tried to address this
- Regulations and guidance essentially developed 30+ years ago
 - I.e., we can benefit from 30 years of changes in technology, improved methods, and lessons learned
- Obstacles?
 - Difficult to change regulations/guidance
 - Difficult to change approach (old dogs; new tricks)



Decision Risk



Basic Tenets?

- Remove “*conservatism on top of conservatism on top of conservatism....*”
 - Otherwise GIGO
- “Models should be as simple as possible and no simpler” (Morgan & Henrion, 1990)
 - Smarter tools, not bigger ones
- Radioactive waste management tail is wagging the nuclear industry dog
 - And we still have legacy waste to deal with



Current Approach

1. Science (fate and transport modeling focus)
 - Hydrology, hydrogeology, geochemistry, soil science, plants, animals, etc.
2. Risk/dose assessment
 - Human health – risk or dose
 - Ecological risk
3. Statistics and Decision Analysis
 - Bayesian for decision modeling
4. Stakeholder engagement/communication



Paradigm Shift

1. Stakeholder engagement/communication
2. Statistics and Decision Analysis
 - Bayesian for decision modeling
3. Risk/dose assessment
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Benefits of the Paradigm Shift

- Holistic approach to solving decision problems
 - Stakeholders are engaged (ownership)
 - Better decisions are made!
 - Defensible, transparent, traceable
 - ALARA opens the door for DOE problems
- “We” are going here....*
- *Other industries and agencies are already doing this*



Example EPA Applications

- SMARTe – Sustainable Management Approaches and Revitalization Tools
 - *Brownfields revitalization*
- Re-imagining Cleveland
 - *Regional land use planning*
- DASEES – Decision Analysis for a Sustainable Environment, Economy, and Society –
 - *Land re-use*
 - *Watershed management*
 - *Coral reef management*
 - *Social network tool for stakeholder involvement*
- Asbestos remediation
- Vapor intrusion characterization

Example Applications

- DoD – cleanup chemical warfare agents
- MMRP – characterize and remediate UXO
- FDA – prioritizing resources for mitigating foodborne illnesses
- Climatology – fire prediction, ecological observatory design
- Risk management, environmental liability issues for commercial industry

The evolution is happening!

Tight budgets – need to focus on better solutions, need some optimization!



Radiation Applications

- NTS (NNSS) – options analysis for Smoky Site
 - Saved \$200M, protective, defensible, transparent
- NTS (NNSS) Areas 3 and 5 Radioactive Waste Management Sites – supported optimized disposal and closure (DOE)
- *EnergySolutions*, Clive, Utah – disposal and closure decisions (NRC, Utah)
- Waste Control Specialists, West Texas –disposal decisions (NRC, Texas)
- LANL – options analysis for RH TRU (NEPA)



Summary

Decision Analysis provides the appropriate paradigm for evaluating cost-benefit of alternative options

This approach is achievable with current technology, and has been implemented for some complex environmental problems

The process can (should) be stakeholder driven

Science side of decision models should be based on “reasonable realism”

It is fine to make conservative decisions, but not to make important decisions based on conservative models

We need this approach to help optimize decision making for environmental and waste management decisions

If we do this right, we get compliance with fewer resources



What to Expect During Elicitation



Structured Decision Making

1. Understand Context
1. Define Objectives
1. Identify Options
1. Evaluate Options
1. Take Action

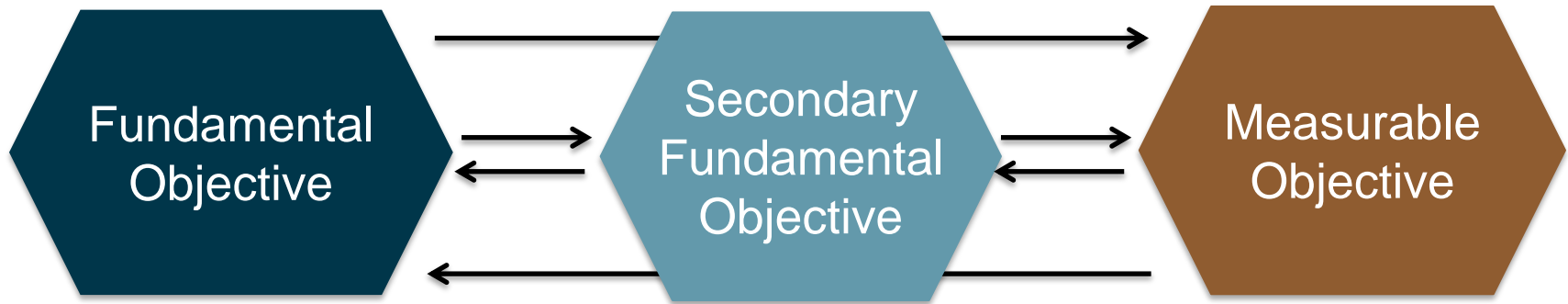


Types of Questions to Expect

- What matters to you or your constituents?
- How much more does X matter than Y?
- How much better is a little bit more of X?
- What options are available? What does the science tell us? How certain of your solution do you want to be?



Eliciting Objectives



Elicitor: *Name something that matters to you in how this problem is solved.*

Stakeholder: *We care about minimizing the cost of the cover.*

Elicitor: *Why?*

Stakeholder: *Well, I suppose we actually want to minimize disposal costs.*

Elicitor: *Why?*

Stakeholder: *We actually want to minimize overall costs.*

Elicitor: *Why?*

Stakeholder: *Because the costs are paid for with taxpayer money.*



Key Points During Elicitation

- In the value judgment step, there are no wrong answers – just your opinions.
- The elicitor will not try to change your opinion, but may push you to help guide you to express your values in a way that can be used in the decision analysis framework.

Let's get started ...



Structured Decision Making

- Understand Context
- Define Objectives
- Identify Options
- Evaluate Options
- Take Action



Decision Landscape

“Just the Facts”



Decision Landscape

- This describes the basic decision landscape
- Stakeholders should always modify or add to this basic framework, for example:
 - Suggest other stakeholders
 - Other potentially exposed groups
 - Other regulations
- This background material is intended to get the “deliberative” process going
 - That is, get stakeholders to think about the problem



Decision Landscape - Context

Problem Statement

- A challenging radioactive waste stream requires a long-term disposal option
- A specific disposal facility is under consideration
 - Several stakeholder groups have an interest
 - Various regulations apply
 - The environmental system has potential upward and downward pathways



Decision Landscape – Interjection

- This is essentially a radiological performance assessment (PA), as would be done in support of a disposal facility for LLW
 - Safety Assessment under IAEA guidance.
- The model includes many typical features and processes that would be part of a PA, but is entirely **fictitious**
- This generic example does not represent any particular site and is used for **demonstration purposes only**

Stakeholder Landscape

- Department of Energy-National Nuclear Security Agency (DOE-NNSA)
- State Department of Environment
- Environmental Protection Agency (EPA)
- Other regulators (BLM, F&W, Forest Service, etc.)
- Native Americans
- Local public
- Activist groups (e.g., Sierra Club, NRDC)
- International community (information exchange, ideas, concern)

Regulatory Landscape

- DOE Orders
 - 435.1, 450.1, 458.1, Price-Anderson
- EPA Regulations
 - RCRA/CERCLA
 - TRU waste?
 - Air, water, etc.
- FFA with the State
- ARARs
- IAEA



Regulatory Landscape – DOE

- Comply with DOE Orders
- Address ALARA
 - ALARA is what can open the door to this DA approach
 - Find the optimal solution - address regulations and the 3 pillars of sustainability
- Comply with State Regulations
 - Address Federal Facility Agreements
- Meet other Federal Regulations
 - ARARs (“applicable or relevant and appropriate requirements” - path to other regulations)

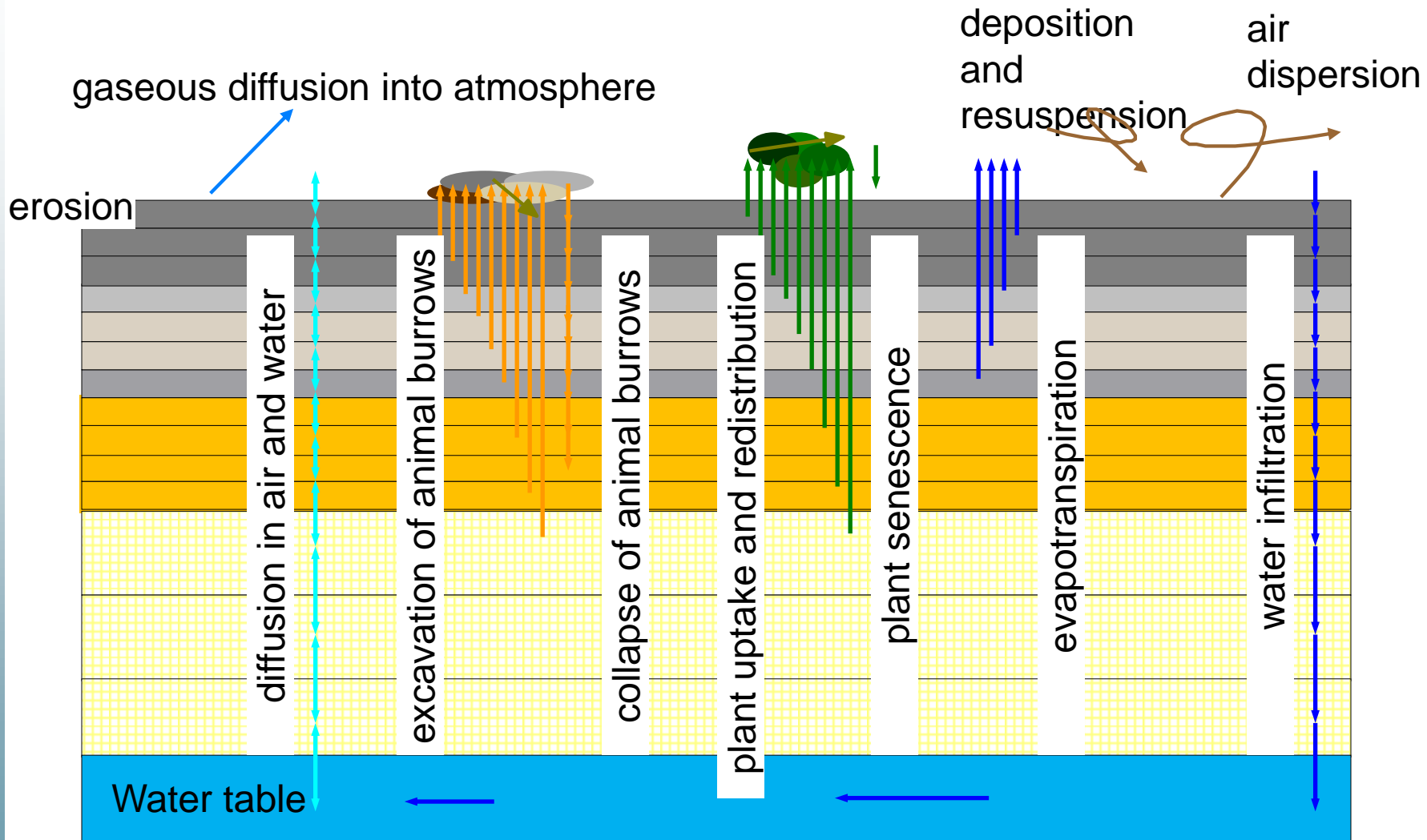


Regulatory Landscape – State

- Federal Facilities Agreement refers to various ARARs, and allows State regulators to regulate potential radionuclide contamination
- State Water Quality Act requirements must be satisfied
 - State has a non-degradation policy for state waters
- Consent decrees and fines



Scientific Landscape



Structured Decision Making

1. Understand Context

- Regulatory, social, and environmental setting
- Scientific setting
- Decision landscape
- Conceptual model
- Social network analysis

2. Define Objectives

3. Identify Options

4. Evaluate Options

5. Take Action



Structured Decision Making

1. Understand Context

2. Define Objectives

a. Fundamental objectives

b. Measurable attributes

c. Value functions

d. Objectives preference weighting

3. Identify Options

4. Evaluate Options

5. Take Action





Structured Decision Making

1. Understand Context
2. Define Objectives
3. Identify Options
 - a. Define options
 - b. Tie options to objectives
 - c. Develop management scenarios
(combinations of options)
4. Evaluate Options
5. Take Action





Structured Decision Making

1. Understand Context
2. Define Objectives
3. Identify Options
4. Evaluate Options
 - a. Develop science-based models (probabilistic modeling) for each option and measurable attribute
 - b. Perform uncertainty analysis
 - c. Perform sensitivity analysis
5. Take Action





Structured Decision Making

1. Understand Context
2. Define Objectives
3. Identify Options
4. Evaluate Options
5. Take Action
 - a. Choose optimal decision option or collect more data/information (including model refinement as necessary)
 - b. Iterate if necessary





This is a piece of cake!



Paradigm Shift – Impact

- Turns the focus ...
 - From a conservative to a “realistic” analysis
 - From starting with the decision-science before the natural science
 - From an alternatives-focus to a values-focus
- Results in solutions that ...
 - Will likely reduce costs
 - Are safe and compliant
 - Are technically defensible, transparent, and traceable

